limit the legitimate use of water. In many States and cities either the ice is inspected or the source from which it is obtained, or the local sanitary authority controls its cutting or sale.

Spitting on the floor of public conveyances or on the side-walks—a dirty habit which creates a nuisance and favours the spread of tuberculosis—is prohibited by regulations which have been very generally adopted. It has, however, been found insufficient to forbid spitting on the floor of conveyances, as it is said that persons seeing such a rule have deliberately spat upon some other portion of the conveyance. A recent State definition of a nuisance (Utah, 1899) is very commendable. A nuisance is "whatever is dangerous to human life or health, and whatever renders soil, air or water impure and unwholesome." The Board of Health of Boston adopted regulations in 1900 for control of the barbers' trade; *inter alia*, mugs, shaving brushes and razors must be immersed in boiling water after every separate use thereof; alum, &c., used to stop the flow of blood, must be so used only in powder form and applied on a towel; the use of powder-puffs and sponges is prohibited; and every barber must cleanse his hands thoroughly immediately after serving each customer. These refinements of sanitation must be very difficult to enforce.

There are excellent reasons why the care of the sick poor should be a part of health department work, and the care of these is in a number of States wholly or partially in the charge of the health department. In most cases it is the outdoor or dispensary work which is given to the health department, but in rarer instances that department also manages the public general hospitals.

The sweating system is said to be associated with, if it be not the direct cause of, the most terrible phase of human life that is to be found in the United States. The "sweat-shop" is a manufactory in the dwellings of the very poor, among whom, if the home be healthy, the labour reasonable and the wages fair, such work is by no means to be discouraged; but the conditions of labour are often such as lead to the destruction of the home by the overcrowding and intense application and competition and the starvation wages of the sweating system. American legislation fails, like our own, to bring about any sufficient amelioration of the disease and misery entailed by the sweating system.

In conclusion, reference may be made to a very useful and full appendix of handbills, forms, notices, &c., used by different sanitary authorities in the United States, which adds much to the value of an interesting and important work.

THE CORRESPONDENCE OF HUYGENS.

Oeuvres complètes de Christiaan Huygens. Publiées par la Société Hollandaise des Sciences. Tome neuvième, Correspondance 1685–1690. Pp. 663 + 3 plates. (La Haye: M. Nijhoff, 1901.)

THE monumental edition of Huygens' works has now reached its ninth volume, and at least one more will be required to complete his voluminous correspondence. When reviewing previous volumes we remarked that many private letters of a non-scientific nature might well have been omitted, as their insertion is the principal cause of the great extent to which the work has grown; but this complaint does not apply to the volume now before us, in which there are scarcely any letters which one could wish omitted, as the few which do not treat of scientific matters give interesting glimpses of life and manners.

In the beginning of 1685 Huygens was still negotiating with the French Government about his return to Paris, and it is not quite clear whether he wanted to go back or not, and whether the revocation of the edict of Nantes was really the sole obstacle. Anyhow, nothing came of the correspondence, and he stayed on at The Hague till the spring of 1688, when he settled at Hofwijck, a property in the neighbourhood of the city which had belonged to his father (who died in March 1687) and of which his elder brother, Constantyn, lent him the use. As Constantyn was secretary to the Prince of Orange, his time was naturally much taken up with affairs of State, but he still found time to correspond with his brother on his favourite pursuit of telescope making, until he had to accompany William III. on his memorable expedition to England in 1688. Several letters give vivid pictures of the great anxiety felt in Holland after the departure of the fleet and the surprise and joy at the rapid progress of the Prince from Torbay to London. The interesting news contained in the letters of Constantyn from London inspired Huygens in the summer of 1689 with a wish to renew old acquaintances and make new ones in England, and accordingly he spent more than two months there, associating with Boyle, Halley, Newton (whom he now met for the first time), his old correspondent Duillier and others. The greatest scientific event of the time was, of course, the publication of Newton's "Principia" two years before. In June 1687 Duillier wrote to Huygens from London that some of the Fellows of the Royal Society were much excited over the approaching publication of a new work by Newton, and mentioned shortly some of the subjects dealt with in it. In reply, Huygens wrote that he was longing to see the book and did not object to the author not being a Cartesian, provided he did not make such an assumption as that of universal attraction. No doubt he and Newton must have had some conversations on the subject in 1689, and two memoranda by Newton on motion in a resisting medium probably date from this visit of Huygens to London. They were already published in 1701 together with a few notes written by Huygens in his copy of the "Principia," which after his death was acquired by a certain Groening, who imagined that Newton's memoranda (which are in his own handwriting) were also written by Huygens. In the "Discours de la Cause de la Pesanteur," published in 1690 with the "Traité de la Lumière," Huygens proves the earth to be an oblate spheroid and explains why the seconds' pendulum is of different length in different latitudes. But he assumes that gravity has its seat at the centre of the earth only, and in the appendix (written after the publication of the "Principia") he refuses to admit that all the particles of two or several bodies attract or tend to approach each other, as it seems clear to him that such attraction cannot be explained by any principle of mechanics. And in a letter to Leibnitz in

the same year he says that he often wonders how Newton could take the trouble to make so many researches and difficult calculations which have no foundation but this principle of universal attraction, which seems to him an absurd one.

With Leibnitz, Huygens was in fairly constant correspondence during the year 1690, chiefly on the subject of the differential and integral calculus, to which Leibnitz invited his attention; these letters have already been published more than once, but are here illustrated by several extracts from the notebooks of Huygens. After the publication of the "Traité de la Lumière" in 1690 (written in Paris twelve years earlier), Leibnitz wrote to express his surprise at, and satisfaction with, the undulatory theory, adding that when he saw how well it accounted for double refraction he passed from esteem to admiration. Papin also wrote to express his general approval, but otherwise there are very few allusions in the correspondence to the wonderful theory of Huygens, which had to lie dormant for more than a century before it even began to be seriously examined and to gain adherents. It is very curious that Newton should reject the undulatory theory of light while Huygens refused to accept the theory of universal gravitation, on both of which theories our modern natural philosophy is founded. But while the objections of Huygens did not retard the progress of the theory of gravitation, Newton's rival theory of light is certainly responsible for the long neglect of the true theory set forth by his Dutch contemporary.

Among the subjects which throughout Huygens' life continued to occupy his mind the improvement of clocks held one of the foremost places, and he never ceased to hope that in this way the important problem of finding the longitude at sea might be solved. Already, in 1662, he had his clocks tried at sea on a voyage from The Hague to London, but the attempt was a complete failure. Although he had in the meantime made the important invention of spiral-spring balances, he felt that even with this essential improvement no watch was to be trusted on a long voyage owing to the great influence of changes of temperature on the rate, and he therefore determined to try his pendulum clocks again at sea. In 1685 he cruised in the Zuyder Zee with two clocks suspended from the ceiling of the cabin in gimbals, and though the sea was very rough one of the clocks kept going the whole time. Encouraged by this success and being assured that the motion of a large ship would be far less violent than that which one of the clocks had been able to withstand, he had the experiment repeated in the following year in a ship belonging to the Dutch East India Company on a voyage to the Cape, giving the captain very detailed instructions as to the management and rating of the clocks. On the return of the *Alcmaer* in 1687 he learned that the clocks had kept going, though not as regularly as he had hoped. Huygens sent a lengthy report to the Company, with a large chart (reproduced in this volume) showing the track of the ship, first as estimated by the pilots, then as calculated by means of the clocks (passing right across Ireland and far to the east of the first one), and finally the same "allowing for the centrifugal force of the earth." This last track agrees fairly well with that laid down by the pilots. The matter was not lost sight of in the following years, notwithstanding the many other occupations of Huygens, and at the end of the volume we find again a number of letters exchanged between him and Graaf, who had brought the *Alcmaer* home from the Cape and who was then about to try the experiment again in another ship. But a great many years were to pass before Harrison solved the problem in quite a different manner.

It is impossible to read this splendid edition of Huygens' correspondence without being struck with the great care bestowed by the editors on their work. Throughout the volumes every allusion to persons, to contemporary events or to scientific matters is explained and commented on in footnotes, often of considerable length, which form a most valuable adjunct to the work. At the head of each letter it is stated where the original is to be found, whether it has been previously printed, and what letter it is in reply to or which one contains the reply to it. Future historians of the science of the seventeenth century will, indeed, have cause to thank the Haarlem Society of Science and especially the editors to whom this national undertaking has been confided.

In addition to the chart already mentioned, the volume contains a plate with views and plans of Hofwijck, where Huygens spent the last seven years of his life, and as frontispiece a fine portrait of the elder Constantyn Huygens from a drawing by his great son.

J. L. E. D.

ELEMENTARY BOTANY.

A Laboratory Course in Plant Physiology. By William F. Ganong, Ph.D. Pp. vi+147. (New York: Holt and Co., 1901.)

Methods in Plant Histology. By Charles J. Chamberlain, Ph.D. Pp. viii + 159. (Chicago: University Press, 1901.)

First Studies of Plant Life. By Geo. Francis Atkinson, Ph.B. Pp. xii+266. (Boston, U.S.A.: Ginn and Co., 1901.) Price 2*s.* 6*d.*

DR. GANONG seems to us to express sound views on the teaching of science in general and of plant physiology in particular, and the remarks on pp. 9 and 10 of his introduction might well be taken to heart by teachers; the same observation applies to his section on "Teaching and Learning," and careful consideration of the rest of this interesting manual convinces us that the author has much of the spirit of the true teacher in him. In other words, he has a share of that genius which calls forth from his students the desire to do something more than merely gather the opinions and statements of others as to the meaning of all those movements, exchanges of matter, increases in size and alterations in volume, &c., which constitute life.

It seems to us that a student who conscientiously works through the subject of this book, in the manner inculcated by the text and imbued with the spirit of inquiry manifested by the author, must learn much that is worth learning, both on account of its value as knowledge of the ways of living plants and on account of its significance in philosophy.

The experiments are as a rule simple, to the point, and